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Statement of

The Under Secretary of Defense for Acquisition and Technology
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Before the
Subcommittee on Defense Technology, Acquisition and Industrial Base
of the Senate Committee on Armed Services

on

Dual Use Technology

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Mr. Chairman and members of the subcommittee, let me express my appreciation for the opportunity to discuss the Department of Defense dual use technology programs and how they support the war fighter's needs.

The Department's investment focus must transition to a broad modernization and recapitalization effort over the current FY96-01 Future Years Defense Program (FYDP). The objective of this effort is to preserve the decisive superiority of U.S. military forces and their weapon systems. However, suitable "technology ramps" must be in place before a robust modernization program can proceed. These ramps must be both relevant and feasible -- relevant to the war fighter's future needs and aligned with the structure of our national industrial base. Both criteria are met by the Department's dual use investment strategy.

Over the past 30 years, the evolutionary change in the industrial base that supports DOD is no less dramatic than the changes in the world order since the demise of the Soviet Union. While DOD purchases have declined, America's commercial markets have continued to expand. The rapid growth of the commercial industrial sector, driven by a commercial market flourishing quite independently of DOD, has reduced the once central role of defense spending as a driving force for innovation.

Chart 1 illustrates the R&D investment expenditures by DOD and private industry since the early 1960's. In aggregate terms, commercial industry surpassed the DOD in R&D spending back in 1965. The disparity between the DOD and commercial sector investment in R&D has been growing wider ever since. This difference means that relatively more of this nation's technological momentum will be based on what's coming out of essentially commercial enterprises.

The bottom line is that we have no choice but to move from separate industrial sectors for defense and commercial markets to an integrated national industrial base. Leveraging commercial technological advances to create military advantage is critical to ensuring that our equipment remains the most advanced in the world. The objective is to marry the momentum of a vigorous, productive, and competitive commercial industrial infrastructure with the unique technologies and systems integration capabilities provided by our defense contractors

A tighter linkage with commercial markets can shorten the cycle time for weapon system development and reduce the cost of inserting technological improvements into DOD weapon systems. The Department of Defense can not afford a 15-year acquisition cycle time when the comparable commercial turnover is every 3-4 years. The issue is not only cost. The lives of our soldiers, sailors, marines and airmen may depend upon shortened acquisition cycle times as well. In a global market, everyone, including our potential adversaries, will gain increasing access to the same commercial technology base. The military advantage goes to the nation who has the best cycle time to capture technologies that are commercially available; incorporate them in weapon systems; and get them fielded first.

DUAL USE STRATEGY

The Department's dual use investment strategy is documented in a February 1995 DOD report entitled *Dual Use Technology: A Defense Strategy for Affordable, Leading-Edge Technology*. This strategy builds on the Department's efforts to improve the defense acquisition process. Improved procurement business practices are the foundation for our efforts to establish an integrated defense-commercial industrial base. The Department's dual use strategy contains three main pillars:

- Invest in dual use technologies critical to military applications;

- Integrate military and commercial production;
- Insert commercial components into military systems.

The first pillar is leveraging the commercial sector's technology base investment. Commercial industry is now the technological agent of change in information systems, telecommunications and micro-electronics. The Department's dual use technology program is tailored to leverage off the commercial technology base without having the taxpayer make the entire root investment.

The second pillar is the "dual produce" concept. The Department is putting a great deal of emphasis on taking advantage of commercial production to manufacture defense equipment. If we can produce weapon system platforms on commercial lines, it will be more the exception than the rule. However, there is great potential for doing this at the subsystem and critical component level of assembly.

The third piece of the strategy calls for DOD to make those investments that are needed to facilitate use of commercial components in defense systems. The objective is to have systems "designed for dual use." This pillar recognizes that acquisition reform and dual use technology investments are not, by themselves, sufficient to ensure use of commercial components. Program managers and contractors still face up-front costs and risks in adopting commercial products and technologies -- for example, the cost of determining that a commercial integrated circuit will withstand the necessary extremes of temperature and humidity, or the cost of engineering a commercial component to fit an existing military system. Where it makes sense, DOD must offset those costs and risks at a level of organization that shares rather than duplicates common costs.

MULTI-CHIP MODULES

A good example of the implementation of the Department's dual use strategy is DOD's investment in an electronic packaging technique -- it is called Multi-Chip Modules or MCMs. MCMs take bare semiconductor chips, and rather than packaging each chip in its own individual package, places those bare chips in a tightly packed format on a single substrate integrated into a single package or module. This electronic module provides fundamental advantages in reduced size, increased performance, and improved reliability over a group of individually packaged chips.

DOD was the early leader in advancing this technology. We can expect MCM technology to find its way into more and more of our equipment. The advantages of MCMs are of critical importance in military applications like "smart" weapons and command and control systems. These advantages will also be important for future leadership in portable and mobile telecommunications and information processing for both the defense and commercial worlds. But, the primary factor now constraining more widespread usage is cost. Currently, MCMs are too expensive for many applications. The most promising way to reduce the cost is to greatly increase production volumes. Our studies show that we can expect unit costs to come down by a factor of ten or more with large scale production.

Our strategy, shown in Chart 2, seems to be working. In 1990 and 1991, there was virtually no commercial market. But we have already seen significant growth in commercial applications, so that commercial applications today are over half of total sales. The Department's current projections are that the market demand for MCMs will grow to several hundred millions of dollars by the turn of the century. And by the turn of the century, the DOD percentage of that market will drop to about ten percent of the total. As a result, the Department is able to buy off commercial MCM lines and capture savings in the prices DOD pays.

The MCM effort pulls together all three pillars of our dual use strategy- support for advanced R&D, support for the design and production infrastructure that will allow us to "dual produce" in commercial facilities, and support for the early insertion of MCMs into military systems where they can make a difference. It also illustrates how a variety of policy tools are used by the Department in implementing this strategy. ARPA's core R&D program has paid for much of the early R&D in this dual use area. The Technology Reinvestment Project (TRP) is supporting several consortia which- with much of the cost shared with industry- are exploring different technical approaches to manufacturing of MCMs which can be used in Defense applications. Our Small Business Innovative Research (SBIR) program has supported several MCM efforts undertaken by our smaller contractors.

The advantages of MCMs are of critical importance in these military applications, and others, like "smart" weapons and command and control systems. An early application will be in the mast mounted sight in the OH-58 helicopter. The MCM is faster, more reliable, and requires less power, and yet it is much smaller than the

portions of the circuit card it replaces. In the F-22, the MCM-based signal processing module will provide functionality that previously required three separate modules, in a vastly smaller footprint, with lower power consumption, and improved performance and reliability

GLOBAL POSITIONING SYSTEM RECEIVERS

DoD's interest in this technology becomes clear when you see how MCMs and other highly integrated circuitry can both decrease the cost and improve the performance of military equipment. Take receivers for our Global Positioning System (GPS) as an example. In the mid-to-late 1980's, our procurement system and military specifications led to the production of a single-channel manpack receiver which weighed 17 pounds and would have cost about $20,000 in full-rate production quantities. But we never bought this receiver at full-rate because, under the previous constraints of doing business in the DOD, it was technologically obsolete by the time it was ready to produce.

Commercial industry was by then already building receivers such as this three-channel Trimble "Slugger" (Small, Lightweight GPS Receiver) which was as capable as the manpack, except for receiving military P-code signals, weighed about 7 pounds and cost about $2000. It was this receiver that the DOD bought in the early 90's, in quantities of several thousand, for use by the ground forces in Desert Storm.

At the same time, the Army and Air Force, through the GPS Joint Program Office, embarked on a major initiative to leverage the technology investments made by commercial industry into military GPS equipment. Today, the results are these Rockwell-produced five-channel GPS receivers: a handheld unit, the "Plugger" (Precision Lightweight GPS Receiver) which weighs 4 pounds and costs less than $1000 and an embeddable unit on a card which weighs about a pound and costs about $10,000 but which, except for power, completely replaces a 12 pound military airborne receiver costing $25,000.

At present, Commercial Off-The-Shelf technology accounts for about 70% of GPS receiver design, mostly in microprocessor and memory chips. Now, the possibilities provided by MCM technology give us the opportunity to evolve GPS receivers even further. Motorola produces a super-chip MCM design which comes off a commercial

production line. It is a six-channel, civil signal GPS receiver package which is expected to cost about $400 in production. The MCM is obviously smaller, cheaper, and uses less power than current designs. In fact, the newest GPS Joint Program Office receiver initiative, called the SAASM (Selective Availability/ Anti-Spoofing Module) will be a full military GPS receiver in an MCM design. Through continuing initiatives by ARPA and the GPS Joint Program Office to rapidly apply commercially generated technology advances in military GPS equipment, we expect to continue driving performance up and costs down as we fully employ GPS across all the military Services.

HOLOGRAPHIC STORAGE DEVICES

At the present time, the Government and industry are sharing technology development costs on ARPA's holographic data storage program. This program is managed by a government-industry consortium to develop next generation data storage technologies. These cost shared partnerships, a precursor to Technology Reinvestment Program (TRP), bring together a network of technical excellence in universities, defense industrial base and commercial industrial base, working toward a generic or core technology base that meets the defense and commercial needs.

The growing capability of computing systems, combined with the ever increasing need to store and retrieve multivariate data sets of enormous proportions from distributed communication systems make holographic data storage systems extremely attractive for their large capacity (exceeding Tbits), short access times (on the order of 10-100 microseconds), large transfer rates (exceeding Gbits/sec) and raggedness. Holographic data storage will have a major impact on National Defense in such areas as battle field data management, large image repositories, super computing, and airborne target recognition, including intelligence. In the industrial sector this technology will revolutionize mass storage applications involving large data sets, such as video on demand, data retrieval from libraries and image repositories on the National Information Infrastructure, as well as a host of consumer applications. The storage market alone is close to $100 billion per year.

TECHNOLOGY REINVESTMENT PROGRAM

These examples emphasize the point that the current dual use strategy builds on a legacy of dual use programs that have long brought benefit to DOD. Our new strategy

is a comprehensive approach to improving the quality and reducing the cost of military systems, updated to respond to the twin transitions– of needs and resources– that we must now make as the Cold War ends.

The subject of dual use technology would not be complete without a discussion of the Technology Reinvestment Project (TRP). I share Secretary Perry's opinion about the importance of this program. The TRP is a key part of our strategy to develop dual use technologies and to integrate military production with the commercial industrial base. I know the TRP has come in for some criticism. Some have called it a conversion program or even considered it to be non-defense spending. My policy has been and will continue to be that TRP projects must have Defense utility and military application.

One of the most important features of the TRP is the requirement for cost sharing. TRP projects allow us to enhance our military capabilities by leveraging the investments in research and development made by industry, bringing industrial creativity to bear on problems important to Defense.

For example, at a hearing on February ninth, General Shalikashvili spoke about how situational awareness on the battlefield may revolutionize modern warfare. Yet many of the technologies needed to improve battlefield awareness, like communications satellites, high performance communications, microprocessors, and advanced flat panel displays are being developed or enhanced by primarily commercial firms. Unless we capitalize on the advances being made by these firms, the total battlefield awareness we seek will be more difficult and expensive to achieve.

I would like to address some individual projects that have been singled out for criticism. One involves the use of composite materials to construct bridges. Some have claimed that bridge building is not a vital defense technology. Despite the criticism, this particular project does have important military applications. The Army Corps of Engineers is a partner in the project because this technology may be used for tactical, mobile bridges which require minimal site preparation. A fast and easy technical solution to the problem of keeping our forces moving over obstacles and barriers is potentially of enormous military importance.

More broadly, composite materials are extremely important for defense, especially with regard to missiles and aircraft. Defense procurements have largely

sustained the production base for composite materials in the past, but the industry has come under severe pressure as a result of lower procurement spending. Without an adequate base of composite manufacturers, high costs could put future aircraft and missile programs in jeopardy. Hence, the composite bridge program also seeks a way to sustain and expand the production base for composite manufacturers. If the project is successful and composite materials can be used for large structures like bridges, production volumes will increase and costs to DOD will come down accordingly.

The Power Electronic Building Blocks for Affordable High Performance Electric Power is another TRP project which has received some criticism. The objective of this effort is to develop high power switching devices having increased switching speed, higher current capability, and the ability to operate at lower temperatures. While these devices will improve power distribution for electric utilities, DOD will also get significant benefits as well. Each Military Service realizes how critical high power switching is becoming to advanced weapon systems. All three Services cooperated on the project proposal and devices that are developed will be tested at laboratories of all three services. For example, the Navy will test applications for ship power supply, sonar power supplies and gun systems. Pulsed radar is another key application for these devices.

I have been in my job now about seven months. So, the TRP was not really invented on my watch. But I must say, that if it did not exist today, the TRP would be precisely the type of program I would be trying to establish to implement the Department's Dual Use Strategy.

SUMMARY

Given DOD's new budget realities and the amount of research being conducted by commercial firms, we must take an innovative approach to technology development and utilization. The examples I've used show how the dual use strategy is improving the quality and reducing the cost of military systems, while updating our response to the adjustments we need to make in a post Cold War world.

If we are to have assured and affordable access to the technologies needed for future military systems then we must reach out and exploit technological advances

being made in the commercial world. I believe the strategy I've outlined here today is a prudent way to accomplish that goal.